

Chapter 7 Preparation for Construction

7-1. Materials Acceptance Testing

a. General. Depending on the nature of the project and the guide specification selected, acceptance of the concrete materials proposed for use on a project will be based on testing in a government laboratory, certified test results, or certificates of compliance submitted by the Contractor. An important responsibility of the resident engineer's staff is to assure that materials submitted for testing or that certificates of compliance represent the actual materials proposed for use.

b. Cement, pozzolan, and GGBF slag. The requirements for the acceptance testing of cement, pozzolan, and GGBF slag are stated in the various guide specifications for concrete. The policy and responsibilities for carrying out the cement, pozzolan, and GGBF slag acceptance testing function of the Corps of Engineers is set forth in ER 1110-1-2002, "Cement, Pozzolan, and Slag Acceptance Testing." The procedures for requesting cement, pozzolan, and GGBF slag testing and the procedures for sampling and testing are outlined in the ER. The USAEWES is responsible for the sampling, testing, and quality verification of cement, pozzolan, and GGBF slag at mill or source locations within the Continental United States (CONUS). Personnel at the district, area, or residency level are responsible for requesting cement, pozzolan, and GGBF slag acceptance testing, determining the amount of the charges, and providing the required funding document to WES. Residency personnel remain responsible for assuring that the cement, pozzolan, and GGBF slag reaching the project site are from sources that have been tested, have not been contaminated in transit, and are properly handled and stored at the project site. When cement or pozzolan is supplied from sealed bins, the members of the residency staff are responsible for sampling, shipping the samples to WES, and sealing the bins and transporting vehicles. For additional information contact CEWES-SC. When cement, pozzolan, and GGBF slag are being supplied from a prequalified source, project samples will be taken and funding to WES provided as outlined in ER 1110-1-2002. Project personnel should sample at the frequency required or may choose to sample more frequently if they suspect that the cement, pozzolan, or slag may be deviating from the specification requirements. There is no additional charge for testing project samples when these samples are taken to aid in assessing a problem with the material being delivered to the project. When cementitious materials are accepted by mill tests, this requirement should be strictly enforced, and a file of the mill test reports should be maintained. Silica fume

will be accepted by certified test reports from the manufacturer.

c. Chemical admixtures. The procedures for acceptance testing of chemical admixtures for concrete are outlined in ASTM C 260, ASTM C 494, and ASTM D 98 (CRD-C 13, 87, and 505, respectively). When acceptance testing is required by the project specifications, sampling will be performed by resident office personnel, and testing will be performed by a division laboratory. To reduce duplication of effort, results of completed tests of chemical admixtures should be routinely furnished to WES in accordance with ER 1110-1-8100, "Laboratory Investigations and Materials Testing."

(1) Test of air-entraining admixtures. The procedures for testing air-entraining admixtures are covered in ASTM C 233 (CRD-C 12), and the specifications for air-entraining admixtures are given in ASTM C 260 (CRD-C 13).

(a) Abbreviated tests. When it has been determined by review of previous data obtained from quality tests that a division laboratory has a sufficient background of information on a given air-entraining admixture to indicate that it is a product of good quality and acceptability as determined by the criteria set forth in ASTM C 260, subsequent samples may be evaluated by abbreviated tests. Abbreviated tests shall consist of performing all tests called for under regular tests except those for determination of compressive and flexural strength at 28 days, 6 months, and 1 year, and resistance to freezing and thawing. Tests to determine compliance with the time-of-setting requirements need not be performed unless specially requested.

(b) Initial uniformity tests. On the first sample of air-entraining admixture tested for a project and found to comply with the applicable requirements by either the quality tests of ASTM C 260 or by the abbreviated tests, initial uniformity tests will be conducted to provide criteria for evaluation of results of uniformity tests on samples representing subsequent lots. The uniformity tests will consist of pH, density, and air content of mortar as outlined in ASTM C 233.

(c) Uniformity tests of subsequent samples. Samples representing a subsequent lot of air-entraining admixture from the same source on the same project as a previous lot tested by quality or abbreviated tests and found to comply with the applicable requirements may be tested by the uniformity test methods outlined in ASTM C 233. The results of uniformity tests will be compared with the results of the initial uniformity tests, and if they agree, the air-entraining admixture may be considered to comply with the

specifications. Rejection of the air-entraining admixture should be based only on full or abbreviated test results.

(2) Test of other chemical admixtures. The specifications and procedures for testing and evaluating chemical admixtures are given in ASTM C 494 and ASTM C 1017 (CRD-C 87 and 88).

(a) Abbreviated tests. When it has been determined by review of previous data obtained from quality tests that a division laboratory has sufficient background of information on a given admixture to indicate that it is a product of good quality and complies with the specifications set forth in ASTM C 494, subsequent samples may be evaluated by abbreviated tests. Abbreviated tests of chemical admixtures shall consist of two rounds of tests for water content, initial time of setting, and compressive strengths at 3, 7, and 28 days.

(b) Initial uniformity tests. On the first sample of admixture tested for a project and complying with the applicable requirements by either the quality tests of ASTM C 494 or by the abbreviated test, initial uniformity tests will be made to provide criteria for evaluation of results of uniformity tests on samples representing subsequent lots. The uniformity tests will consist of density, residue by oven drying, and infrared spectroscopy.

(c) Uniformity test of subsequent samples. Samples representing a subsequent lot of admixture from the same source on the same project as a previous lot tested by quality or abbreviated tests and found to comply with the applicable requirements may be tested by the uniformity test methods outlined in ASTM C 494. The results of these uniformity tests will be compared with the results of the initial uniformity tests, and if they agree, the admixture may be considered to comply with the specifications. Rejection of the admixture should be based on full or abbreviated tests.

(3) Tests of accelerators. If calcium chloride is used on a project using the minor concrete guide specifications, it may be accepted based on recent certification that it complies with ASTM D 98 (CRD-C 505) or ASTM C 494, Type C or E.

d. Aggregates - listed source. When the Contractor proposes to furnish aggregates from a listed source, the resident engineer remains responsible for assuring that the aggregate being produced is of similar quality to that which was tested during the design process. Immediately after receipt of information on the Contractor's source of aggregates, samples should be taken from material produced

by the Contractor and forwarded to a division laboratory for a confirmation of quality. The amount of testing to be conducted will vary with each individual source. Testing program considerations will include length of time since testing was last performed, the amount of material removed from the source since testing was performed, and the variability of the deposit. The resident office should correlate testing requirements with the engineering division materials engineer. The Contractor on mass concrete projects using guide specification CW-03305 will have responsibility for quality testing before mixture proportioning samples are taken.

e. Aggregates - nonlisted source. When the Contractor proposes to furnish aggregates from a source not listed in the specifications, samples will be taken by the Contractor under the supervision of the resident office. The methods of sampling are outlined in CRD-C 100. The approval or disapproval of the proposed source should be handled as quickly as possible, and appropriate personnel from the division and district should make site visits as needed when a major project is involved. The evaluation of test results is primarily a responsibility of the engineering division of the district or division office. The source will be accepted only if the quality meets the required test limits. The aggregate samples will be tested and evaluated in accordance with the guidance provided in Chapter 2 of this manual. All testing will be accomplished in the appropriate division laboratory.

f. Aggregates - minor concrete jobs. Minor concrete job specifications will require the aggregate to meet ASTM C 33 (CRD-C 133) or a state highway specification. If the concrete supplier's source of aggregate is from a local source which has been used for some time, then a service record will have been established and only minimum testing is necessary. The resident engineer or project engineer, however, has the responsibility to ascertain that the aggregates meet the required quality, and if there is any question, such as a newly opened source, quality testing should be performed in the division laboratory.

7-2. Mixture Proportioning

a. For concrete projects using Guide Specification CW-03305, mixture proportioning is the responsibility of the Government. Before the concrete placing starts, the mixture proportioning study should be completed using materials proposed by the Contractor. Chapter 4 of this manual discusses in detail the procedures for sampling of concrete materials for mixture proportioning and for proportioning to meet project requirements. The mixture proportioning criteria are to be provided to project personnel as outlined

in Chapter 6. The importance of submitting samples which meet quality and grading requirements and which are representative of materials to be supplied to the project cannot be overstated. Due to the variation of materials supplied during construction, mixture proportions may need to be adjusted. Adjustment of laboratory mixture proportions should be done during plant shakedown.

b. For projects using Guide Specification CW-03301, the mixture proportioning is the responsibility of the Contractor. Before the concrete placing starts, the Contractor should submit the mixture proportions and all the test reports for review.

c. For structures using Guide Specification CW-03307, the concrete will most likely be supplied by local ready-mixed plants. The Contractor's mixture proportions should be submitted to the resident office and should be checked for appropriateness and completeness before start of concrete production.

7-3. Concrete Plant and Materials

a. *Review of concrete plant drawings.* The contract specifications may require the Contractor to submit drawings showing the layout and material handling details of the proposed concrete plant to the Contracting Officer for review. It is the Contractor's responsibility to provide and maintain a dependable concrete plant of the required capacity. Review comments should be limited to (1) if the plant meets the requirements of the contract specifications or (2) a list of specific deficiencies if the plant does not meet the specified requirements and (3) any other comments on specific plant features or details that are questionable or appear deficient.

b. *Estimating plant capacity.* The capacity of a concrete plant is commonly determined by the number of mixers, the rated capacity of each mixer, along with the charging, mixing, and discharging time of each mixer. The total time required should be increased by 15 sec/batch when the capacity for sustained operation is computed. Thus, a concrete plant that contains two 4-yd³ tilting drum mixers, each of which can be charged in 20 sec and discharged in 15 sec, would have the following computed capacity: A "rule of thumb" mixing time for a 4-yd³, one-opening, tilting-type mixer is 1 min, 45 sec. Therefore, the total time per 4-yd³ batch for such a mixer is:

20 sec	-	charging mixer
1 min, 45 sec	-	mixing
15 sec	-	discharging
15 sec	-	other
<hr/>		
2 min, 35 sec	-	Total

Thus, the concrete plant capacity is 8 yd³ in 2 min, 35 sec or approximately 185 yd³/hr. If the number of mixers is insufficient when judged by the mixing time calculation, which may be the case if the Contractor proposes to use turbine mixers or very large tilting mixers, the plant should be designed so that the extra mixers can be added. Any comments on the concrete plant should point out that the extra mixer(s) will be required if the mixing time proposed by the Contractor does not satisfy the uniformity requirements. Normally, batching time is not critical. However, in a plant equipped with a vertical shaft (turbine) mixer, in which cumulative weighing is employed, the batching cycle should be compared to the mixing cycle to determine which is critical. It is always necessary to make a careful check of the capacity of the material conveying systems into the concrete plant and the concrete transportation system from the concrete plant to the placement site. When placing concrete in the area of the structure that is the most remote from the concrete plant, the concrete transportation system should be capable of handling the entire output of the plant with allowances made for any time required to reposition the discharge equipment and minor delays by the placing crew.

c. *Aggregate storage, reclaiming, washing, and rescreening.* Most project specifications for any size project will require that sufficient aggregate be on the site to permit the continuous placement and completion of any lift started. The contractor's proposed plant for the storage and delivery to and from storage should be checked to determine if they are of sufficient capacity to be able to easily comply with the production capacity requirements. The capacity of the storage bins should be checked against the preliminary mixture proportions to assure adequate size for all mixes. If the fine aggregate is wet when it is stockpiled and there are no mechanical dewatering devices provided, there must be sufficient storage capacity to allow the fine aggregate to drain freely to obtain a uniform and stable moisture content before being deposited in the batch plant bin. Aggregate reclaiming facilities, washing, and rescreening facilities (when required) should be carefully examined to determine that they are of sufficient capacity to maintain all of the bins over the batchers at least half full when the plant is producing concrete at the rated maximum capacity of the plant.

d. Concrete cooling plant capacity. There are two principal requirements of an aggregate cooling system: (1) there must be sufficient refrigeration capacity, and (2) the aggregate must be in contact with cooling system long enough to permit the transfer of sufficient heat between the aggregate and the medium. The refrigeration capacity must be that required for the maximum placing rate during the hottest summer months with an assumed loss of at least 10 percent between cooling and mixing. The length of time required for the heat transfer will depend upon the aggregate size. For example, if 150-mm (6-in.) aggregate is exposed to ice water for 20 min, less than 85 percent of the potential cooling will be accomplished regardless of the size of the refrigeration plant. The aggregate handling facilities should be planned so that heat gain is minimized after cooling. Modern ice-making equipment that can handle ice efficiently is available so that, for saturated aggregates, all the added water can be in the form of ice. It is important that all ice melts prior to the conclusion of mixing. Liquid nitrogen is also extensively used for cooling concrete, especially when the nitrogen manufacturing facilities are within the geographic area. Liquid nitrogen can be sprayed directly into the mixer with no ill effect. The nitrogen must be added while the mixer is turning. ACI 207.4R and the PCA "Design and Control of Concrete Mixtures" (Kosmatka and Panarese 1988) are excellent references for more detailed study.

7-4. Batching and Mixing Equipment

a. Checking compliance with specification requirements. Prior to the beginning of concreting operations, the plant should be checked for compliance with the specification requirements. During the erection of the plant and installation of the equipment on large jobs, the inspection staff should become thoroughly familiar with the plant and its operating features. Plant drawings submitted by the Contractor for review by the Contracting Officer should be used in making the check and in becoming familiar with the plant.

b. Scale checks. All scales should be checked by standard weights before being placed in operation. During plant shakedown and the beginning of concrete production for onsite plants, the operation of the scales should be observed closely. If any trouble is apparent, it should be corrected immediately. Subsequently, the accuracy of the scales should be checked once a month. Checking of scales is a responsibility of the Contractor under the quality control provisions, but the government inspection force has the responsibility for verification. This verification should be accomplished by observation of the scale checks performed

by the Contractor and actually checking scales when an accuracy disagreement occurs.

c. Mixer blades and paddles. Mixer blades should be examined before concrete production begins and must be monitored during construction. If there is a buildup of hardened concrete in the drum or if the blades become badly worn, previously obtained uniformity test data are no longer applicable. Thus, when the blade shows 10-percent wear, the blades should be replaced and additional uniformity tests run. Several methods have been used to monitor blade wear to determine when the blade has worn 10 percent. One method is making a plywood template of portions of the blades. Another is drilling small holes in the blade where "10-percent wear" would be. Another is simple blade measurements. Measurements or holes must be located and recorded so that they can be relocated. Selection of method and monitoring must begin at the time the uniformity test is performed. Pug mill paddles should be checked in a similar manner.

d. Recorders. The agreement between recorder reading and dial indications should be checked regularly. This can be done easily whenever scales are calibrated, although it may be done any time the scales are in operation. The pens on pen recorders should be examined frequently to ensure that they are not clogged, that they have a supply of ink, and that they do not produce too wide a line. It is a source of convenience to write on the chart the location at which concrete is being placed at any time.

e. Batching sequence. When aggregates are batched cumulatively, the last material batched has its mass recorded with the least accuracy since the tolerances in project specifications apply to the total mass in the hopper rather than to the mass of the individual fraction. If possible, fine aggregate should not be batched first or last. It should be batched second, following the coarse aggregate fraction having the smallest mass. Batching sequence can have a profound effect on mixing time for most mixers. If a charging conveyor is used, then ribboning materials together on the belt as much as possible can result in more efficient mixing and shorter mixing time. Liquid admixtures should be batched with the water or damp sand. Each chemical admixture should be batched separately and should be batched at the same point in the charging cycle for every batch.

f. Mixer performance and mixing time. The mixing time at the start of a job using onsite plant mixers should be determined prior to the start of concrete production. On jobs covered by Guide Specification CW-03305, mixer

performance tests will be conducted by the Contractor as required by the specifications. The mixer performance tests for plant mixers are performed in accordance with CRD-C 55 at the specified intervals. The mixer performance tests for plant mixers using continuous mixers are to be performed in accordance with CRD-C 55 with the spacing of the sampling intervals modified as appropriate for the continuous operation. Allowable variation will be the same as for batch mixers. When truck mixers are in use on any size job, their performance will be determined at the specified intervals in accordance with ASTM C 94 (CRD-C 31) and shall meet the variation tolerance specified therein. When mobile volumetric batching and continuous mixing plants are used for minor structures, mixer performance tests shall be performed in accordance with and shall meet the variation tolerance specified in ASTM C 685 (CRD-C 98). When plant mixers are used, tests at reduced mixing times will be made by the Government any time reduced mixing times are proposed by the Contractor. Tests may be conducted by the Government at the initial startup of the plant for mass-concrete jobs if desired.

7-5. Conveying Concrete

a. General. Transportation of concrete from the mixer to the forms should be done as rapidly as possible so that the properties of the concrete as discharged from the mixer are not changed materially. The devices used for receiving the concrete from the mixers and conveying it to and depositing it in the forms should be designed to maintain the concrete in the same condition in which it is discharged from the mixer. ACI 304R provides an easily obtainable source of information on transporting concrete. The contractor's conveying system should be reviewed and appropriate comments provided.

b. Buckets. When concrete is transported from mixer to forms in bottom-dump buckets, controllable discharge buckets are required. The specifications limit the size of the pile in which concrete may be deposited to 4 yd³. However, buckets with a capacity greater than 4 yd³ may be used if they have multiple discharge gates or other controls so that more than one pile is deposited on discharge, none of which exceeds 4 yd³.

c. Truck mixers and agitators. Truck mixers will not adequately mix concrete made with aggregate having a maximum nominal maximum size greater than 37.5 mm (1-1/2 in.) and should not be used for mixing or transporting and agitating such concrete or concrete with 2-in. slump or less. In general, whenever truck mixers are permitted for mixing concrete, agitators may be used for hauling concrete in the event the contractor elects to use centrally mixed

concrete, except that agitators will not be used when it is necessary to delay mixing of the batched material until the truck has arrived at the construction site. This requirement may occur when the batching, conveying, mixing, and placing operations would require more time than allowed by the specifications or when the rate of placement is so slow or intermittent that mixing cannot be properly scheduled at the central mixing plant. In such situations, a procedure of batching all the materials except cement, and not more than 80 percent of the water at the batch plant, and transporting to the construction site where the cement and remaining water is batched and the concrete mixed, should be used.

d. Nonagitating equipment. Truck-mounted nonagitating equipment specifically designed for hauling concrete may be used for a haul requiring less than 15 min over a smooth road. Standard dump trucks should never be used to haul conventional concrete.

e. Positive-displacement pump. The transportation of concrete through pipelines by positive-displacement pumps is an acceptable method for transporting concrete of medium consistency. This method is especially useful for tunnel linings and other areas with insufficient room for handling buckets. Pumps may be authorized whenever the aggregate size, slump, and length of line are within the manufacturer's recommendations for the apparatus proposed and the desired quality of concrete can be obtained. A positive-displacement pump is a piston pump or a squeeze pressure pump. A pneumatic pump is not a positive-displacement pump. The use of aluminum for concrete pump pipe is not permitted. The use of aluminum pipe is potentially dangerous and could result in substantial reduction in the strength of the concrete. Refer to ACI 304.2R for more information on placing concrete by pumping methods.

f. Belts. Slow conveyor belts are unacceptable as standard practice for transporting concrete. This method tends to produce segregation as the concrete travels on a slow belt. Any belt traveling at less than 300 ft/min is considered slow. When making the decision on whether or not to permit the use of conveyor belts to transport concrete, residency or area personnel should refer to ACI 304.4R which includes information on parameters and specifications for belt placement. Regardless of the outcome of the analysis of the contractor's proposal, the use of a belt conveyor should be discontinued if excessive segregation results.

g. Chutes. Chutes which are supplied by the ready-mixed truck manufacturer as a normal part of the ready-mixed trucks are usually satisfactory. Most other chutes tend to segregate the concrete as it is discharged and should not be approved.

7-6. Preparation for Placing

a. General. Placing of concrete should not be permitted until preparations have been completed. Preparation for placing includes form construction, cleanup of surfaces, assembling of placing and protection equipment, and other operations essential to proper concreting operations.

b. Earth foundations. Earth foundations should be properly compacted and should be clean and damp prior to placing the concrete.

c. Rock foundations. Rock foundations should be thoroughly cleaned and given any other necessary treatment required to ensure proper bond of the concrete to the rock. Roughening by "bush hammering" or by sandblasting may be necessary on certain types of rock; however, the removal of all loose coatings, scale, drummy rock, dried grout, and other similar materials usually provides a surface of required roughness.

d. Cleanup of concrete surfaces. Construction joints in concrete to which other concrete is to be bonded must be thoroughly cleaned to remove laitance and other harmful coating. When properly prepared, the surface of the concrete will present only clean coarse aggregate surfaces and sound mortar. Roughness is not necessarily a requirement. Cleanup of construction joints is usually accomplished by either one of three methods or by the use of a combination of these methods. These are the air-water cutting (green-cut), high-pressure water jet, and sandblasting methods. Some job specifications contain an optional provision, which if invoked, makes it possible for the Contractor to use a surface-applied retarder to extend the period of time during which air-water cutting is effective. When the Contractor elects to use a surface retarder, he is required to submit a sample for approval and to demonstrate the method of application. The surface retarder should meet the requirements of CRD-C 94. The principal requirement to be met by the application procedure is that it supply a uniform coat in all kinds of weather. Without retardation, the use of the air-water method requires particular care if satisfactory results are to be obtained. The time at which the air-water cutting should be accomplished is critical and is materially influenced by prevailing temperature conditions. When properly timed, the surface can be cleaned so that laitance resulting from bleeding is removed. Frequently, the proper timing of the operations on the entire surface of a lift in a large dam is not achieved and this probability should be considered before the method is approved. Cutting too early by the air-water or high-pressure water jet method results in damage to the surface

by undercutting the large aggregate and in the removal and wasting of otherwise suitable concrete. Cutting too late results in failure to clean the surface properly and necessitates wet sandblasting. A pressure of 3,000 psi appears to be adequate for cleaning concrete by the high-pressure water jet for concrete with strength of 3,000 psi. Higher strength concrete may require a pressure up to as much as 6,000 psi. Trials should be conducted on project concrete to establish the correct pressure. Cleaning by the sandblast method is accomplished after the surface has hardened and should be delayed as long as practicable, preferably until just prior to placing the next lift. The Contractor will be required to provide means for handling the disposal of the joint cleanup waste so that exposed surfaces will not be stained or otherwise damaged. Light sandblasting to remove surface stains resulting from faulty cleanup operations or the use of unsuitable curing water is permissible, but it will not be necessary if the cleanup operations are properly executed. The best bond between lifts is obtained when the surface of the old concrete is neither bone dry nor saturated but has been saturated and is in a drying condition.

e. Placing equipment. The requirements for placing equipment vary widely from job to job, depending on the plant used and placing conditions. The necessary facilities should be reviewed in advance and provided ready for use. In reviewing, attention should be given to the following specific items.

(1) Vibrators. Vibrators should comply with specification requirements. A sufficient number of vibrators should be at the job site to permit placing. Also there should be a reasonable number of spare vibrators available.

(2) Cold-weather and hot-weather protection equipment. Devices and methods proposed by the Contractor must meet the specifications requirements for cold-weather and hot-weather concreting. The equipment should be examined for adequacy and applicability well in advance of winter concreting so that any deficiencies may be corrected by the Contractor. Refer to ACI 305R and ACI 306R for more information on hot-weather and cold-weather concreting.

(3) Communication equipment. The Contractor should provide equipment for his use between the forms and mixing plant. The need for other equipment such as signaling and identifying devices depends on the complexity of the project and the number of different concrete mixtures employed. The resident engineer should require the Contractor to present for review plans or descriptions of the equipment well in advance of the start of concrete

placement. The GQA representative should be provided with separate communication equipment between the forms and mixing plant on large jobs where the mixture proportions are provided by the Government.

(4) Other equipment. The need for additional equipment depends on job requirements. Such equipment includes wire brooms for spreading grout, water removal equipment, elephant trunks, etc.

f. Forms. The type of forms to be used by the Contractor will be submitted for approval prior to construction. The submittal should be checked for compliance with the specifications.

g. Curing and protection. The methods and equipment proposed by the Contractor for the curing and protection of concrete should be reviewed to assure that they are capable of curing the concrete and protecting it in compliance with the specifications. Follow-up inspections should assure that the approved materials and equipment for curing and protection are available at the project site prior to the beginning of concrete placement.

h. Approval. Concrete placing should never begin until approval to do so by the Government has been given. A form checkout record should be used for larger and more

complex projects. The record should include form line and grade, grout tightness of the form, proper size numbers and position of reinforcement, waterstops, mechanical or electrical lines, cleanup of foundation or previous lift, proper transportation, placing and vibrating equipment, and curing and protection equipment. Both the government quality verifier and the Contractor's foreman should sign or initial the record. Figure 7-1 is a sample of a form checkout record.

i. Interim slabs on grade. Unless there is some other overriding reason, interior slabs on grade should be underlain by a capillary water barrier consisting of 4 to 6 in. of open-graded granular material, preferably crushed rock. While some engineers consider a vapor barrier unnecessary, it is usually good practice to install a vapor barrier below the concrete slab and above the capillary water barriers. This consists of a continuous plastic sheet, 6 mil or more thick. In some parts of the country, particularly the Southwest, it is customary to cover the vapor barrier with 2 in. of sand because of the concern that, without the separator, warping of the slab would be intensified. While in other parts of the country the vapor barrier is customarily placed directly beneath the concrete slab without a sand separator, it would be conservative practice to use the sand separator unless previous experience shows no need for it.

FORM CHECKOUT						
I T E M	INSPECTED BY			APPROVED BY		
	CONTRACTOR			CORPS OF ENGINEERS		
	NAME	DATE	TIME	NAME	DATE	TIME
GEOLOGY FOUNDATION						
DRAINAGE						
CROSS SECTION						
FORMS						
LINE & GRADE CONTROL CONCRETE PLACING						
REINFORCING						
PIPING						
WATER STOP						
ANCHOR BOLTS						
MISC. MECHANICAL						
ELECTRICAL						
CLEANUP						
SAFETY REQUIREMENTS						
WEATHER PROTECTION						
VIBRATING EQUIPMENT						
CURING MATERIALS						
FINAL CLEARANCE						
CONTRACTOR REPRS:				C.O.E. REPRS:		
<p style="text-align: center;"><u>I N S T R U C T I O N S</u></p> <p>CONCRETE PLACING SHALL NOT BEGIN UNTIL EVERY ITEM IS CHECKED AND THE FINAL CLEARANCE IS SIGNED.</p> <p>IF ANY ITEM IS NOT APPLICABLE, IT SHALL BE NOTED "NA" AND SIGNED.</p> <p>BEFORE APPROVING THE "SAFETY REQUIREMENTS" ITEM, A FINAL INSPECTION SHALL BE MADE OF ALL WORKING FACILITIES FOR CONCRETE PLACING SUCH AS SCAFFOLDS, LADDERS, PLATFORMS, ACCESS WAYS, ETC., TO ASSURE THAT THEY ARE ADEQUATE, SAFELY CONSTRUCTED, AND IN READINESS.</p> <p>FINAL CLEARANCE SUBJECT TO REVOCATION IF SUBSEQUENT INSPECTION REVEALS ANY DEFICIENCIES.</p> <p>IF SUMMONED BY THE CONTRACTOR TO CHECK AN ITEM AND IT IS FOUND TO BE UNSATISFACTORY, STATE IN THE "REMARKS" COLUMN THE TIME SUMMONED AND THE TIME REJECTED.</p>						

Figure 7-1. Example of form checkout record